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SONIFYING HAMLET

by

ASHLEIGH CASSEMERE-STANFIELD

A capstone project submitted to the Graduate Faculty in Liberal Studies in partial fulfillment of the
requirements for the degree of Master of Arts, The City University of New York

2017



2017

Ashleigh Cassemere-Stanfield

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Sonifying Hamlet

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Ashleigh Cassemere-Stanfield

This capstone project has been read and accepted for the Graduate Faculty in Liberal Studies in satisfaction of the thesis requirement for the degree of Master of Arts.

Date

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ABSTRACT

Sonifying Hamlet

by

Ashleigh Cassemere-Stanfield

Advisor: Professor Jessica Yood

Sonifying Hamlet uses data-mining techniques and algorithmic composition to read Shakespeare's *Hamlet* through sound. In so doing, it attends to pre-semantic, textual data that is only visible when one steps back from reading for narrative and instead focuses on formal details that, being individually small, but collectively numerous, are more visible to computational sorting than they are to human eyes that have been trained to look for broad semantic content. This use of algorithmically generated sound to reconstruct textual data continues the western trend towards ubiquitous quantification, while also challenging that trend's underlying assumption that reality is reducible to fully discrete objects of study. That is, as nonlinguistic sound interacts with the other intonations of a place, it constructs a unique acoustic moment that obscures the distinction between individual datum, and between textual objects and the physical world. In this way, *Sonifying Hamlet* explores the physical and temporally constrained construction of an environment as a form of reading.

By simultaneously engaging with and resisting quantification trends in the digital humanities, *Sonifying Hamlet* attempts to inject ambiguity into a rising digital empiricism. In this way, it answers a call for such methods posed by digital humanists themselves for whom confrontation with the enigmatic is as potent a mode of knowing as scientific inquiry. Through its imbrication of the unnamable and the enumerated, *Sonifying Hamlet* attempts to support scholars by facilitating digital inquiry that is commensurate with the expansiveness of what is thinkable and expressible in human discourse.

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SONIFYING HAMLET

I. Introduction

Sonifying Hamlet is an app that facilitates the exploration of *Hamlet*'s textual data through sound.¹ The seven sonifications that compose this project each create acoustic spaces in which to listen to the iteration of the text's character and thematic networks as they unfurl in time, and as inflected by a given constraint. In their aims and their results, these sonifications are deformations of the text residing somewhere between empirical data display and a more ludic imaginary. Here the literary object, *Hamlet*, is understood to be an algorithm for the organization of digital sound. As such, textual features such as the frequency with which characters speak and the dispersion of topics throughout the text are here mapped onto electronic instruments and together made to sound out the text's patterns of presence, absence, enunciation and silence. Through its imbrication of literature, computation, and abstract sound, *Sonifying Hamlet* experiments with the remapping and (re-)potentialization of a familiar text through the production of affective and indeterminate acoustic texts.

*

Sonification is the aural display of data through non-speech sound such that correlations between data and audio are rule-based and reproducible.² It is a technique of data display originating in the sciences and used with increasing ubiquity to facilitate data exploration and trend identification, ambient monitoring of listener environments, and artistic practice. Through sonification, *Sonifying Hamlet* leverages the aptness with which sound conveys temporal data in order to construct a spatial environment through its blending with the other intonations of a place. As this spatial environment is itself a new text, nonlinguistic sound enables *Sonifying Hamlet* to go beyond just translating and representing its base text,

¹ <http://sonifyinghamlet.com/>

² Hermann, Thomas, Andy Hunt, and John G. Neuhoff, eds., *The Sonification Handbook*. (Berlin: Logos Verlag, 2011.)

and to instead build a new literary-acoustic-computational hybrid with whom the reader-listener may engage, interpret and deconstruct in their turn.

As nonlinguistic sound affords the ability to abstract out the patterns of a narrative while maintaining their temporal exposition, it likewise affords a foregrounding of the play of erasure and recovery through which textual data connect, echo and contend with one another, and of the gaps in sense, the silence, residing in the interstices between data. These textual abstractions, while potentially recoverable through other means, are here granted a sensuousness that allows the text to here envelop and touch the reader through the physicality of sound. Promiscuous in its mixture with the ambient sounds of the external world, with the sounds of the reader's own body attending to itself, and with the reader-listener's acoustic attention just then, the textual environment thus composed consists of the full acoustic moment, as much the sounds produced by the machine as the sounds arising out of the location in which the reader listens. This acoustic text evolves moment to moment as changes in the program state, the reader and the location iterate its form in that instance.

To an extent this process of being as becoming would be true of any text, regardless of its medium. The experience of an object, be it sonic, visual, tactile, linguistic, etc., is ever contingent on the experience of the objects that are immediately adjacent to it. Nonlinguistic sound is semi-unique in that it affords the dissolution of boundaries between like media. Where the sight of two adjacent books does not impair one's ability to distinguish one from the other, the sound of two adjacent acoustic phenomena may obscure the boundary between them. Within *Sonifying Hamlet* this affords the ability to layer textual patterns such as to create a diversity of semi-unified acoustic objects, each of them a possible world of intersection and hermeneutic collusion. Thus, through each of these worlds, this acoustic text renders a different potentialization of the narrative's temporality within the physical space of the reader-listener. Where Thomas Rickert advocates for a rhetorical theory and practice that foregrounds and affirms the

ambient composition of the human and her ecological entanglement, *Sonifying Hamlet* leverages code, sound and text in order to perform the emergent potential of that ambience.³

This re-potentialization of *Hamlet*'s narrative expands the hypertextual, hypersensual world that is the body of *Hamlet* scholarship, the play's creative remediations, and its circulation within popular discourse. Through this, *Sonifying Hamlet* opens *Hamlet* up to new interpretations and uses, while simultaneously standing on its own as an aesthetic object subject to novel use and interpretation. In this way, *SH* is of a kind with the play's mass media incarnations, its innumerable scholarly glosses, the pre-Shakespearean legends from which *Hamlet* originates, and the differences between the folios themselves. Specific to its use of computation, *Sonifying Hamlet* belongs to the field of the digital humanities and, within that, to the practices of deformation and algorithmic criticism.

Deformance is the decomposition of a text in order to reconstruct it as a site for fresh interpretive insight. This definition comes from Jerome McGann and Lisa Samuels who establish the term and argue for its neglected utility within the academic-critical arsenal of interpretive tools.⁴ For them, deformance enables the "[reinvestigation of] the terms in which critical commentary will be taken."⁵ That is, in addition to engendering renewed textual novelty, deformance supports a meta-awareness of how and why one interprets a text as one does.

Building on McGann and Samuels, Stephen Ramsey advocates for an 'algorithmic criticism' whose heart lies within deformative procedure. For him, this criticism 'employ[s] the rigid, inexorable, uncompromising logic of algorithmic transformation as [a] constraint under which critical vision may flourish' through the generation of new contexts for reading and writing.⁶ In his formulation, algorithmic criticism is of a kind with the ludic imaginary of Alfred Jarry's pataphysics and with the experimental formalism of Oulipo and, as such, it "is concerned not with determining the facts of the text, but with the

³ Thomas J. Rickert, *Ambient Rhetoric: The Attunements of Rhetorical Being* (Pittsburgh, PA: University of Pittsburgh Press, 2013).

⁴ Jerome McGann, and Lisa Samuels, "Deformance and Interpretation." in *Poetry & Pedagogy: The Challenge of the Contemporary*, eds. Joan Retallack and Juliana Spahr. (New York: Palgrave Macmillan, 2006.), 151-180.

⁵ Ibid.

⁶ Stephen Ramsay, *Reading Machines: Toward an Algorithmic Criticism* (Champaign: University of Illinois Press, 2011), 32.

implications of the text in its potentialized form.”⁷ In this way, pataphysics, Oulipo and algorithmic criticism are all three extreme instantiations of the core of humanistic inquiry, which “relies on a heuristic of radical transformation [where the] critic who endeavors to put forth a ‘reading’ puts forth not the text, but a new text in which the data has been paraphrased, elaborated, selected, truncated, and transduced.”⁸ In other words, to subject a textual object to the strictures of computation is to necessarily create a new textual object that both comments on its predecessor and stands on its own as an aesthetic object replete with sites for interpretation and critique.

Drawing further on McGann, Samuels and Ramsey, to engage in deformative criticism is thus to move from a declaratory perspective that diagnoses the text and its worldly context, to an inquisitive perspective that speculates on forms the text could take and its world could take in relation to it. This is a move from *if-then* to *what-if* that facilitates the reconsideration of communal norms of reading and the uses for a given text, while rendering the constructedness and contingency of any given position visible. Yet, despite its utility, a move to the *what-if* of novelty is only transiently potent, for with the daily abuse of habit, each nascent view soon finds its disjunction and its strangeness obscured by its own successful propagation. Thus, deformance as a communal site of scholarship requires perpetual experimentation with new methods in order to seek out the continued estrangement of the world as encountered through its texts.

In pursuit of such fortuitous awkwardness, *Sonifying Hamlet*, decomposes its base text into decontextualized tokens, word counts, and the simple appearance of forms (with no concern on the part of the computer for the meaning of those forms). In so doing, *SH* sets aside all narrative functionality, and instead places the text’s characters, situations and themes in the service of algorithmic music and its exigencies. Whether one once understood Hamlet to be a hero or a villain, accelerating the play’s course of events, or impeding them, his functions within the narrative are altogether different within the medium of sound. Here his function is to keep time, to iterate the text’s patterns of sonic difference and self-

⁷ Ibid., 67.

⁸ Ibid., 16.

similarity, to assist in the organized chaos of Chance I and II, and to determine the topic priorities of the text in Themes III. He shares these functions with the other members of the main cast. To engage with him as he singularly functions within these sonifications, one might say that Hamlet, in his verbosity, exists as a black hole rivaling silence behind which all other character sounds are eventually subsumed. That is, in these sonifications he works to produce an acoustic antithesis to nothingness that is still nothingness for everyone around him. Each of the characters and themes that catalyze *Sonifying Hamlet's* movements are here subject to renewed interpretation. And as one listens to their rhythms as constrained by textual patterns, one is not listening to the play itself, but to a new thing that is (hopefully) productively odd in its commitments.⁹

The textual estrangement of *SH's* sonifications, exists only insofar as the project achieves its own insufficiency. That is, it must fail and foreground that failure as a hermeneutic good. Here the terms of success are set in equal measure by the empiricist underpinnings of computation, and by the more explicitly hermeneutic goals of humanistic inquiry such that neither is dominant and thus neither is fully satisfiable. Within code, to be successful is to 'correctly' render the flows and processes of a given thing in mathematical form. But what is the 'correct' mathematization of the humors that permeate the play's narrative, or of its intertextual relationship to Judeo-Christian religion? Within the humanities, reading is the pursuit of context with which to organize the real. Yet, what human context can make the real of machinic "knowledge" any less alien, when it lacks both the self-reflexive experience of its own limitations and the affective capacity to make those limitations mean something? Further, Joanna Drucker has argued cogently that even the idea of data is slippery insofar as to reduce a situation to data requires excising the majority of its information.¹⁰ That is, data begins with an interpretive choice of what to count

⁹ Mark Sample argues that the term deformation is a hedge that privileges how the new text calls back to and reconstructs the base text, over and against how the new text stands on its own as critical-aesthetic object. In its place, he offers the stronger term, deformation, which privileges how the new text stands on its own and invites the same critical attention as the base text. I use the terms interchangeably here, though my thought is perhaps closer to Sample's. See: Mark Sample, "Notes Toward a Deformed Humanities." *samplerreality.com*. 2012.

¹⁰ Johanna Drucker, "Humanistic Theory and Digital Scholarship." in *Debates in the Digital Humanities*. (Minneapolis: University of Minnesota Press, 2012), kindle location 2342, and "Humanities Approaches to Graphical Display." *Digital Humanities Quarterly* 5, no 1 (2011).

and how to delineate the separation between objects that are in actuality contingent and continuous. One could have always chosen otherwise, and thus, working from data no more ensures a “correct” representation of a situation than a more discursive rendering would. By privileging neither humanistic nor empiricist knowing, and recognizing the nonobjective nature of data in all its forms, *SH* ensures that its deformations are multilateral in that its humanistic and empiricist tools constrain each other in equal measure. That is, as the rigidity of code and the machinic correlations of topic modeling constrain the production of sound and thereby render it semi-referential, the temporal and spatial dispersion of sound and its tendency to blend with itself, deforms this very rigidity and performs the continuity and contingency residing at its core. Further, as the play’s textual features determine many of the limits of what may be selected, both code and sound constrains the utility of those features. Through this multilateral deformation, the sonifications found here foreground what their epistemological foundations attempt to remainder.

This remainder, this surplus meaning is *Sonifying Hamlet’s* failure and its strength. It is a point of indeterminacy, born from the inability of *SH’s* component parts to fully account for, collude with, or dominate one another. In her descriptions of the productive capacity of intersecting literary, political, and otherwise social forms, Caroline Levine writes that

[literary] form does not operate outside of the social but works among many organizing principles, all circulating in a world jam-packed with other arrangements. [Within a text or environment] each constraint will encounter many other, different organizing principles, and its power to impose order will itself be constrained, and at times unsettled, by other forms... *New encounters may activate latent affordances or foreclose otherwise dominant ones.* (emphasis mine)¹¹

¹¹ Caroline Levine. *Forms: Whole, Rhythm, Hierarchy, Network*. (Princeton: Princeton University Press, 2015), 7.

Intersecting forms thus create a set of potentialities whose possible outcomes cannot be fully accounted for by any of their individual organizing principles. That is, through the excavation of one another's subterranean affordances, code, text and abstract sound here create a situation in which new realities may be forged. That this renewed potentiality is here conceived of in terms of failure is drawn from Eldritch Priest's work on the aesthetics of failure in experimental music. He states that the remaindered meaning foregrounded by failure, "exposes a culture's limits and absurdities, its structures of desire and orders of the real...[and it] directs judgement towards something non-functional, something that creates an irresistible alliance with a network of significations..."¹² To fail is thus to reveal the constructedness of any given position through the production of equally seductive alternatives. It is to engender a hermeneutic abundance that deconstructs the received valuations of our objects, activities and organizational schemes. Further, as "failure has no particular point, [as] it is radically perspectival and, ultimately, despite the regularities that restrict its measure, radically indeterminate," it is thus a period of free play within the enclosing epistemologies that demarcate "success."¹³

That *Sonifying Hamlet* renders its (re-)potentializations of *Hamlet*'s narrative as affective and indeterminate acoustic texts foregrounds the background intelligibility from which ideas and objects emerge, while deconstructing the appearance that such emergence was necessary. Where Rickert would cast this in terms of a platonic chora, Priest might describe these potentialized spaces as aural sigils, constructing the known world and incanting a sense of its contingency, contradiction and "sensuous infinity".^{14 15} In either case, these acoustic texts posit a form of "reading" that is the construction of a physical environment redolent with inessential and remaindered hermeneutic potential. This "reading" is thus a failure to read, a failure to delineate and order the quanta of the real. In reference to the limitations

¹² Priest, *Boring Formless Nonsense*, Kindle Locations 204-205 and 239-241.

¹³ Ibid, Kindle location 218.

¹⁴ Rickert, *Ambient Rhetoric*.

¹⁵ Priest, *Boring Formless Nonsense*, Kindle Location 803.

of the Turing machine and the conceptual revolutions borne of it, Ramsey asks “how more gloriously and fruitfully [algorithmic criticism] might fail” and in failing foment the humanistic practice of ever generating new questions and perspectives.¹⁶ How indeed.

¹⁶ Ramsay, *Reading Machines*, 68.

II. Methodology

Sonifying Hamlet is a realtime app through which the textual data of Shakespeare's *Hamlet* is decontextualized and reconstructed as acoustic objects. Within each sonification, a set of pre-created sounds have been tied to various textual events which the user may select. These events include the frequency with which individual characters speak, the frequency with which other characters appear adjacent to the presently speaking characters (i.e. the iteration of the text's networks of physical proximity), the appearance of computationally sorted topics, and the appearance of thematically significant words. In each case, the available options enable the users to customize the sonification according to their textual and acoustic interests. This thereby renders the play as both an object to be data-mined acoustically, and as a constraint on production of computational music. That is, *SH* supports the text's oscillation between the center and periphery of user attention.

Sonifying Hamlet was coded in Javascript. It makes use of the following libraries: Socket.IO, Express, Howler.JS, JQuery, XML2JS, Browserfy, Watchify, and Nodemon. The sounds of *Sonifying Hamlet* were selected from Logic Pro X. Sounds tied to textual data were created by recording individual notes of Logic's pre-built instruments. Background sounds were selected from Logic's prebuilt loops. Additionally, MALLET was used to topic model the text for topic-oriented sonifications.

The text *Hamlet* was chosen for its accessibility and ubiquity. That is to say that *Hamlet* is a public domain text that is widely read and performed. While the sonifications themselves, the acoustic component of *Sonifying Hamlet*, are instances of fair use and would thus be feasible with literary objects that are still under copyright, *Sonifying Hamlet* also reproduces the entire text verbatim as a means of allowing the user to track what section is being sonified at any given moment. This feature thus requires an expired copyright. In regards to the text's ubiquity, as *Hamlet* is so widely read, and, more pointedly, as I have read it and seen it performed so many times at different stages of my life, I have long since lost the sense of strangeness and hermeneutic potency that colored my first few encounters with it. As this project is about creating an alien thing from something familiar, testing the success of this new novelty

meant choosing what is for me the very antithesis of novelty. All of this is not to deny that *Hamlet* is a remarkable play. It's just that the focus of *Sonifying Hamlet* is the experiment in acoustically remediating a literary object and as such *Hamlet* is here a means to an end. Truthfully, any similarly accessible and ubiquitous text would have done just as well.

*

Beginning with the Folger Library's xml file of *Hamlet*, the first step towards creating *Sonifying Hamlet* was to render this file in usable and compact format. For this, the file was first converted to JSON format using `xml2js`, a node library, and then a parser script was written to reconstruct the dialogue absent xml tags. Next, the text was topic modeled. This entailed first dividing the reconstructed text into 'bags of words', wherein the full speech of each character became a bag. (For especially verbose characters, their speech was divided into several bags). Then, these bags were processed through MALLET, which output a set of topics in txt format. This text file was then converted to JSON by hand. Next, a series of functions were written to break dialogue from the reconstructed text down into 1-3 line chunks*, and to associate each of these chunks with its associated topics, with the characters for whom those topics dominated their speech, with other characters who were then present in the scene, with the word counts of the given line and of the other characters then present, and with thematically significant words. Additionally, functions were written to create ordering templates, as well as the topic bags and speaker bags needed for Chance I and II. The output of all of these were combined into single file which serves as the basis for all of the app's sonifications.

Once this sonification guide was constructed, a module was created which builds and emits the actual sonification data according to this guide, the audio files, and user selection. Each sonification is built as follows:

- **Background Audio:** Each sonification has a unique background loop. At the start of each sonification, the audio file associated with this is emitted to the browser.
- **All sonifications:** Except where otherwise noted, each sonification traverses user selected scenes in 1-3 line chunks*, according to a timer (one chunk every 5 seconds).

- Presence I: If the current chunk is spoken by a character that the user has selected, then a log of the intensity/volume of the play's characters is updated, such that the more a character speaks the louder they will sound when they are also-present-but-not-currently-speaking. Similarly, the more a character speaks while another character is not present in the scene, the quieter that also-present-but-not-currently-speaking character will sound. After this, a sonification object is built consisting of the dialogue chunk, the speaker's audio, the audio files of the other characters present in the scene, and the intensity log. This object is then emitted to the browser where it is decoded and rendered.
- Presence II: Similar to Presence I, if the current chunk is spoken by a character that the user has selected, then a log of where the characters are in space is updated, such that a character moves more to center the more they speak, and moves away from center the more others speak. After this, a sonification object is built consisting of the dialogue chunk, the speaker's audio, and the spatial log. This object is then emitted to the browser where it is decoded and rendered.
- Themes I: If the current chunk is correlated to a topic that the user has selected, then a sonification object is built consisting of the dialogue chunk and the topic's audio. This object is then emitted to the browser where it is decoded and rendered.
- Themes II: This sonification's timer is 1.5 seconds instead of the 5 seconds used for the others. If the current chunk contains one or more theme words (or their synonyms) that the user has selected, then a sonification object is built consisting of the dialogue chunk, the audio for the selected and matched words, and the audio for all characters present in that scene. This object is then emitted to the browser where it is decoded and rendered.
- Themes III: If the current chunk is correlated to topics, which are themselves the dominant topics of at least one user selected character, then a sonification object is built consisting of the dialogue chunk, the audio of speaker, a record of which characters' top three topics were matched, and a

record of whose very top topic was matched. This object is then emitted to the browser where it is decoded and rendered.

- Chance I: In place of traversing selected scenes in 1-3 line chunks, this sonification traverses selected scenes according to the order in which characters speak. Once every 5 seconds, it moves to the next character in that scene's order. If that character has been selected by the user, a bag of dialogue is built consisting of all of that character's dialogue from all of the selected scenes. One chunk of 1-3* lines is then randomly selected and added to a sonification object that also contains the audio file of the speaker, and audio files of any topics matched to that randomly selected dialogue chunk. This object is then emitted to the browser where it is decoded and rendered.
- Chance II: In place of traversing selected scenes in 1-3 line chunks, this sonification traverses selected scenes according to the order in which topics appear. Once every 5 seconds, it moves to the next set of topics in that scene's order. If a topic in that set has been selected by the user, then a bag of dialogue is built consisting of all of lines of dialogue correlated to that topic from all of the selected scenes. If more than one user selected topic is present in that set, then one of these is randomly selected and a bag of dialogue is built consisting of all of lines of dialogue correlated to that topic from all of the selected scenes. One chunk of 1-3 lines* is then randomly selected from this bag and added to a sonification object that also contains the audio file of the speaker of that randomly selected dialogue chunk. This object is then emitted to the browser where it is decoded and rendered.
- Client-side: A handful of client-side modules handle collecting user selections, emitting them to the server, decoding and rendering audio and textual data as it is received, and managing pause, seek, and volume options.

* The dialogue is chunked in this way in order to break up especially long passages.

III. Evaluation and Continuation

Where *Sonifying Hamlet* performs the indeterminacy of the text, it facilitates a semi-open-ended and creative user interaction, wherein the reader-listener has some control over what features are selected for and what outputs therefore result. This greatly expands the repeat usability of the platform insofar as it exponentially increases the number of user experiences that one can pursue within it. Beyond the options that users are given, this performative indeterminacy is implicit insofar as *SH* reads *Hamlet* through the construction of acoustic spaces which are necessarily colored by the user's own environment. In the case of Chance I and II, *SH* explicitly perform this indeterminacy through the use of computer-generated pseudo-randomness.¹⁷ This pseudo-randomness exponentially increases the possible transformations of the play within this acoustic structure and in so doing, it entwines itself with the moment in which it is produced. That is, as the number of possible combinations here far exceeds what can be listened to in a human lifetime, the probability of a given user hearing the exact same chance combination is negligible. Thus, the moment in which one listens is effectively the only moment in which that specific textual transformation even exists. Aesthetically, Chance I and II therefore share similarities to Raymond Queneau's text(s) 100,000,000,000,000 poems, while going further so as to make their readings unrecoverable in the manner of John Cage's chance operations.

The indeterminacy of *Sonifying Hamlet*'s productions works to render the sonifications more affectively suasive than linguistically so. Earlier drafts of the platform pursued this end more deliberately through the attempted use of infrasound. Where infrasound (sound below 20HZ) produces a pre-hermeneutic feeling of anxiety, *SH* attempted to construct a sonification wherein all characters began in the infrasonic range, rose out of it as they spoke and returned to it as others spoke. In the way, *SH* attempted to allow the user to explore a soundscape wherein everything begins and ends in anxiety. Technical limitations prevented me from continuing on this tract in the short term. In the long term,

¹⁷ Computers are unable to produce actual randomness and so pseudo-random number generators work by producing sufficient variety so as to give the appearance of randomness to a human observer.

increased technical skill and increased competency in psychoacoustics will hopefully enable me to approximate this affect reliably in later platform additions.

Further work on *Sonifying Hamlet* is needed to improve mobile performance, text rendering, the spatialization of Presence II and topic improvement. With respect to the latter, the topics in Themes I, III, and Chance II, while functional as acoustic constraints, could do to have greater distribution and variability across the text. Improving this is a matter of experimenting with how the text is binned and run through MALLET. This is all in addition to the ongoing work of debugging and maintaining platform security.

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Tools:

Javascript - NodeJS - Socket.IO - Express - Howler.JS - JQuery - XML2JS - Browserfy - Watchify - Nodemon

Logic Pro X

MALLET

Provocations for Listening

Within the app, each of these provocations prefaces its related sonification.

Presence I.

Other than memory and direct reference, what if, through the ripples of intersection, a player inhaled in the voices of the still breathing, still speaking persons with whom that player has had contact? And if the strength of this continued existence correlated to the frequency with which one found himself in the company of a given character, could he then be said to reside more in them, than in himself? Find in this sonification tools to dwell within these questions. Here each character has been assigned a sound that is particular to them. The first time each speaks, that sound will play, and so will the sounds of all the other characters that share that scene. In each scene thereafter, each time this character speaks those prior voices will inhere, but their intensity will decay with every word that player speaks without them near. And to their fading chorus will join the stronger sounds of those now present. Sonically, what begins in Act I, Scenes I and II as undifferentiated drones begin to articulate difference as characters mingle and iterate the networks of the play. Through these constraints each player presences as a node within an evolving matrix of connections. As you listen consider whose voices mingle with whom within the space of a given player's moment and how the play's affinity networks may be therefore understood to be 'networks of ruin'.^{18 19}

Presence II.

What if in contradistinction to the inherent embeddedness of being, to persist in the space of this play is to continually render oneself and only oneself through speech? If one *is* only insofar as one can be

¹⁸ Alexander Galloway, "Networks," in *Critical Terms for Media Studies*, eds. W. J. T. Mitchell and Mark B. Hansen. (Chicago: The University of Chicago Press, 2010), Kindle Locations 4215-4216.

¹⁹ *Sonifying Hamlet* is not the first project offer a network analysis of Hamlet. See: Franco Moretti, "Network Theory, Plot Analysis," Stanford: Stanford Literary Lab, (2011), and James Stiller, Daniel Nettle and Robin I.M. Dunbar, "The Small World of Shakespeare's Plays," *Human Nature* 14.4 (2003), 397-408. Where both examine the connections between characters atemporally, compare *Sonifying Hamlet*'s engagement with the emergent character of the text's networks.

heard above the murmurs of community and fate, then in what ways does *Hamlet* describe several varied retreats into solipsism? Find in this sonification the voices of several solitary souls iterating their isolation. Here each character has been assigned a sound that is particular to them. Beginning at relatively low volume on the edges of the auditory field, the first time each character speaks, her sound will play. With each word that belongs to her, her sound will increase in volume, while edging closer to auditory center. For every word that does not belong to her, her sound will slowly fade and retreat back to its starting place on the margins. Here each player emerges out of silence and obscurity in order to iterate themselves solipsistically. In this way, the ebb and flow of each character's presence is made audible and comparable the other characters of the play. Similarly, the slow decay of each voice after its player has ceased speaking causes periods of overlap and blending whence the listener may observe how the reins of power and presence are passed from character to character. As you listen, consider how the aggregation of words, as opposed to their specific meaning, articulates a desire to move freely beyond the dictates of ethics, of mood, and of fate.

Themes I.

If the periodic emergence of a theme iterates a temporal unity, that is, a rhythm, then what diverse compilations of these rhythms distinguish scene from scene?²⁰ And what if, through these rhythms, *Hamlet's* players spoke not to those who share the stage in that moment, but to those who occupy the next beat in their thematic movement? What could then be said through and about these distributed conversations? Find in this sonification tools with which to algorithmically track the emergence, clustering and dispersion of *Hamlet's* thematic elements. Here each theme has been assigned a sound that is particular to it. These sounds will play whenever phrases correlated to a given theme appear. In this

²⁰ Drawing on Caroline Levine's point that literature and society are necessarily composed of multiple, simultaneous, yet uncoordinated temporal rhythms linking the past to the present in complex ways, *Sonifying Hamlet* proceeds via the discovery and composition of temporal diversities out of textual phenomena. These differ from the diversities that Levine alludes to insofar as the temporalities of *Sonifying Hamlet* are not drawn from institutional norms, but are instead computationally-delineated according to the frequency with which characters speak, the frequency with which characters occupy the same scene, the statistical correlation of words to one another (thereby instantiating a topic or theme) and the application of computational pseudo-randomness to these textual features. See: Levine, *Forms*, 49-81.

way, the listener will be able to hear the thematic and temporal diversities that move the play as much as, and maybe more so than, its plot. As you listen, consider the specific shape of the silence composed by what goes unsaid by whom and when.

Themes II.

Beyond suicide and Christian ethics, beyond kinship and oedipal frustration, beyond these and all of *Hamlet*'s articulable themes, what if the players could be said to gather around the unnamed *it* that demarcates a shared concern that only becomes visible through the discourse of an assembled community? If one attempts to algorithmically read *Hamlet*'s process of calling the court to order that it may both construct and adjudicate a matter of consequence, then is it enough to read this call in the appearance of individual and thematically weighty words? Find in this sonification a continually (re-)constructed audience for the naming of *Hamlet*'s concerns. Here individual words are treated as nascent objects of shared concern, around whom the community assembles in order to define its contours and to be recursively defined in turn. As in Presence I and II, each character has here been assigned a sound that is unique to them. Every time a selected word appears, and only when it appears, the sounds of all of the characters present in that scene will play as a proxy for the gathering of implicated minds. In this way, one can sonically contemplate *Hamlet* as a continual reshuffling, or rather, reimagining of its discursive communities. As you listen, consider how the frequency with which these communities assemble changes over time. Similarly, consider in which pivotal or dull scenes these gatherings most frequently occur.

Themes III.

In selecting Ophelia, or Gertrude, or whomever, what if every word in the play not correlated to the dominant topics of that chosen player were cut away? Could one then be said to see the play through the eyes of a solitary character? Could one who barely speaks become a sieve through which the play's priorities are strained? Find in this sonification the tools for just such perspectival whittling. Here one chooses a single character whose dominant themes will constrain their speech and that of every other

character's as well. Then, when any player speaks a word correlated to those themes, a sound *unique to the speaker* will play. For example, if Hamlet is chosen as the sieve, then the sound unique to Ophelia will only play when she speaks words correlated to Hamlet's themes. Through such constraint, the play is again and again made to conform to the preoccupations of its individual nodes. As you listen, consider how differences in rhythm, movement and momentum are afforded by each character's perspective.

Chance I

What if the procession of characters speaking were privileged above what any one of them actually said in their moment? What if, in an intensification of the solipsism of Presence II, each player were but a bag of lines who spoke for the sake of speaking and not in connection to their neighbor? Find in this sonification just such chaotic isolation. Here the specific order in which characters speak has been preserved, but the lines presented and sonified are randomly selected from the totality of all of a given character's lines. For each of those lines, both a sound particular to the character will play, as will a sound specific to the thematic content of that line. In this way, every run of this sonification will produce a new revision of the text. As you listen, consider how each character presences as a black box of sensible connections.

Chance II.

What if the play were less a procession of events, than it were a procession of themes wherein the specific player enunciating a topic were irrelevant? Where Themes I treated *Hamlet's* themes as temporally dispersed conversations that superseded a character's immediate context, what if these themes were treated as a bag from which characters randomly presence? Would sense become less a matter of speaking to another, than of belonging to a given container? Find here a sonification to explore this reassessment of what it means to make sense. Here the specific order in which themes present has been preserved, but who speaks and which specific line is spoken are randomly selected from the totality of all lines correlated to that theme. For each of these thematic events, a sound particular to the randomly

chosen character will play. As in *Chance I*, every run of this sonification will produce a new revision of the text. As you listen, consider how the play's themes circulate and structure the text independently of the characters.